In the Claims

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Claims 91-93 are canceled.

Amend claims 63, 83 and 88 of remaining claims 32, 34, 36-42, 44, 46, 48, 49, 51, 53 and 55-90.

1.- 31 (Canceled)

32. (Previously Presented) A method of making a magnetic read head, which includes a spin valve sensor, comprising the steps of:

a making of the spin valve sensor comprising the steps of:

forming a free layer structure that has a magnetic moment and an easy axis;

forming a ferromagnetic pinned layer structure that has a magnetic moment;

forming a pinning layer exchange coupled to the pinned layer structure for pinning the magnetic moment of the pinned layer structure;

forming a nonmagnetic conductive spacer layer between the free layer structure and the pinned layer structure;

forming the free layer structure by obliquely ion beam sputtering at least one cobalt

forming the free layer structure by obliquely ion beam sputtering at least one cobalt or cobalt based layer in the presence of a magnetic field oriented in a direction of said easy axis; and

the oblique ion beam sputtering being at angles $\alpha = 40^{\circ}$ and $\beta = 10^{\circ}$ - 30° , wherein angles α and β form first and second planes respectively which are orthogonal with respect to one another.

33. (Canceled)

34. (Previously Presented) A method of making a magnetic read head, which includes a spin valve sensor, comprising the steps of:

a making of the spin valve sensor comprising the steps of:

forming a free layer structure that has a magnetic moment and an easy axis;

forming a ferromagnetic pinned layer structure that has a magnetic moment;

forming a pinning layer exchange coupled to the pinned layer structure for pinning the magnetic moment of the pinned layer structure;

forming a nonmagnetic conductive spacer layer between the free layer structure and the pinned layer structure;

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10	f	orming the free layer structu	are by obliquely ion beam sputtering at least one cobalt
11	or cobalt based layer in the presence of a magnetic field oriented in a direction of said easy		
12	axis;		
13	. t i	he pinning layer structure be	eing formed by forming a nickel oxide (NiO) layer and
14	an alpha	iron oxide (α FeO) layer	wherein each of the nickel oxide (NiO) layer and the
15	alpha irc	on oxide (α FeO) layer has	been formed by oblique ion beam sputtering at angles
16	α and β	wherein angles α and β	form first and second planes respectively which are
17	orthogo	nal with respect to one and	other.
	35. (Canceled)	
1	36. (Previously Presented)	A method as claimed in claim 32 further comprising
2	the steps of:		·
3	forming	the free layer structure wit	h a nickel iron based layer that interfaces the cobalt or
4	cobalt based lay	•	
5	said forr	ning of the cobalt or cobal	It based layer so that it interfaces the spacer layer.
1	37. ((Previously Presented)	A method as claimed in claim 36 further comprising
2	the step of:		
3	after s	aid oblique ion beam spu	attering in the presence of said field oriented in said
4	direction of the	e easy axis, further formi	ing said at least one cobalt or cobalt based layer by
5	annealing said a	t least one cobalt or cobal	t based layer.
1	38.	(Previously Presented)	A method as claimed in claim 36 wherein said cobalt
2	based layer is fo	ormed of cobalt iron (CoFe	e).
1	39.	(Previously Presented)	A method as claimed in claim 38 wherein said
2	annealing is at a	a temperature from 150°C	to 270°C.
1	40.	(Previously Presented)	A method of making a magnetic read head, which
2	includes a spin	valve sensor, comprising t	he steps of
3	forming	the spin valve sensor as for	ollows:
4		forming a ferromagnetic p	inned layer structure that has a magnetic moment;
5		forming a pinning layer exc	hange coupled to the pinned layer structure for pinning
6		gnetic moment of the pinne	
7		forming a nonmagnetic con	ductive spacer layer between the free layer structure and
8	the pin	ned layer structure; and	
O	me him	icu iayei siructure, and	

9	forming the pinning layer structure of a nickel oxide (NiO) layer and an alpha iron		
10	oxide (αFeO) layer wherein at least one of the nickel oxide (NiO) layer and the alpha iron		
11	oxide (α FeO) layer has been obliquely ion beam sputtered at angles α and β wherein angles		
12	α and β form first and second planes respectively which are orthogonal with respect to one		
13	another.		
1	41. (Previously Presented) A method of making a magnetic read head, which		
2	includes a spin valve sensor, comprising:		
3	a making of the spin valve sensor including the steps of:		
4	forming a free layer structure that has a magnetic moment and an easy axis;		
5	forming a ferromagnetic pinned layer structure that has a magnetic moment;		
6	forming a pinning layer exchange coupled to the pinned layer structure for pinning		
7	the magnetic moment of the pinned layer structure;		
8	forming a nonmagnetic conductive spacer layer between the free layer structure and		
9	the pinned layer structure;		
10	a making the free layer structure including the steps of:		
11	obliquely ion beam sputtering first and second cobalt or cobalt based layers		
12	and a nickel iron based layer in the presence of a magnetic field oriented in a		
13	direction of said easy axis with the first and second cobalt or cobalt based layers		
14	interfacing the spacer layer and a cap layer respectively and the nickel iron based		
15	layer being located between and interfacing the first and second cobalt or cobalt		
16	based layers,		
17	the oblique ion beam sputtering being at angles $\alpha = 40^{\circ}$ and $\beta = 10^{\circ}$ - 30°		
18	wherein angles α and β form first and second planes respectively which are		
19	orthogonal with respect to one another; and		
20	after said oblique ion beam sputtering in the presence of said field oriented		
21	in said direction on the easy axis, annealing each of the cobalt or cobalt based		
22	layers and the nickel iron based layer.		
1	42. (Previously Presented) A method as claimed in claim 41 including:		
2	forming nonmagnetic nonconductive first and second read gap layers;		
3	forming the spin valve sensor between the first and second read gap layers;		
4	forming ferromagnetic first and second shield layers; and		
5	forming the first and second read gap layers between the first and second shield layers.		

43. (Canceled)

1	44.	(Previously Presented)	A method as claimed in claim 42 wherein a forming		
2	of the pinned layer structure comprises the steps of:				
3	forming ferromagnetic first and second antiparallel (AP) pinned layers with the first A				
4	layer interfac	ing the pinning layer; and			
5	formi	forming an antiparallel (AP) coupling layer between the first and second AP layers.			
	45.	(Canceled)			
1	46.	(Previously Presented)	A method as claimed in claim 44 wherein the step		
2	of oblique io	n beam sputtering includes th	e steps of:		
3	provi	ding a sputtering chamber;			
4	provi	iding a nonmagnetic conduct	ive target in the sputtering chamber that has a nominal		
5	planar surfac	ee;			
6	positi	oning a substrate in the cham	ther that has a nominal planar surface at angles α and β		
7	to the nominal planar surface of the target;				
8	prov	iding an ion beam gun in the	e chamber for bombarding the target with ions which		
9	causes ions o	f the material to be sputtered	from the target and deposited on the substrate to form		
10	said cobalt o	r cobalt based layers; and			
11	angle	$\alpha = 40^{\circ}$ and angle $\beta = 10^{\circ}$ - 3	30° wherein angles α and β form first and second planes		
12	respectively v	which are orthogonal with resp	pect to one another and are angles between the nominal		
13	surface plane	es of the target and the substr	rate.		
	47.	(Canceled)			
1	48.	(Previously Presented)	A method of making magnetic head assembly that		
2	includes a w	rite head and a read head, co	mprising the steps of:		

a making of the write head including:

forming ferromagnetic first and second pole piece layers in pole tip, yoke and back gap regions wherein the yoke region is located between the pole tip and back gap regions;

forming a nonmagnetic nonconductive write gap layer between the first and second pole piece layers in the pole tip region,

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8	forming an insulation stack with at least one coil layer embedded therein between
9	the first and second pole piece layers in the yoke region; and
10	connecting the first and second pole piece layers at said back gap region, and
11	making the read head as follows:
12	forming a spin valve sensor and first and second nonmagnetic first and second read
13	gap layers with the spin valve sensor located between the first and second read gap layers;
14	forming a ferromagnetic first shield layer, and
15	forming the first and second read gap layers between the first shield layer and the
16	first pole piece layer; and
17	a making of the spin valve sensor comprising the steps of
18	forming a free layer structure that has a magnetic moment and an easy axis;
19	forming a ferromagnetic pinned layer structure that has a magnetic moment;
20	forming a pinning layer exchange coupled to the pinned layer structure for pinning
21	the magnetic moment of the pinned layer structure;
22	forming a nonmagnetic conductive spacer layer between the free layer structure and
23	the pinned layer structure;
24	a making of the free layer structure including the step of:
25	obliquely ion beam sputtering first and second cobalt or cobalt based layers
26	and a nickel iron based layer in the presence of a magnetic field oriented in a
27	direction of said easy axis with the first and second cobalt or cobalt based layers
28	interfacing the spacer layer structure and a gap layer respectively and the nickel
29	iron based layer being located between and interfacing the first and second cobalt
30	or cobalt based layers,
31	the oblique ion beam sputtering being at angles $\alpha = 40^{\circ}$ and $\beta = 10^{\circ}$ - 30°
32	wherein angles α and β form first and second planes respectively which are
33	orthogonal with respect to one another; and
34	after said oblique ion beam sputtering in the presence of said field oriented
35	in said direction of the easy axis, annealing each of the cobalt or cobalt based
36	layers and the nickel iron based layer.
1	49. (Previously Presented) A method as described in claim 48 including:
2	forming a ferromagnetic second shield layer;
3	forming a nonmagnetic isolation layer between the second shield layer and the first pole
4	piece layer.

50. (Canceled)

51.	(Previously Presented)	A method as claimed in claim 48 wherein a forming
of the pinned	layer structure comprises	the steps of:

forming ferromagnetic first and second antiparallel (AP) pinned layers with the first AP pinned layer interfacing the pinning layer; and

forming an antiparallel (AP) coupling layer located between the first and second AP layers.

52. (Canceled)

53. (Previously Presented) A method as claimed in claim 51 wherein the step of oblique ion beam sputtering includes the steps of:

providing a sputtering chamber;

providing a nonmagnetic conductive target in the sputtering chamber that has a nominal planar surface;

positioning a substrate in the chamber that has a nominal planar surface at an angle to the nominal planar surface of the target;

providing an ion beam gun in the chamber for bombarding the target with ions which causes ions of the material to be sputtered from the target and deposited on the substrate to form said cobalt or cobalt based layers.

54. (Canceled)

55. (Previously Presented) A method of making a magnetic layer and/or an antiferromagnetic (AFM) layer for an electrical device comprising the steps of:

obliquely ion beam sputtering at least one material layer from a target onto a substrate to form said magnetic layer and/or antiferromagnetic (AFM) layer;

the oblique ion beam sputtering being at angles α and β wherein each angle α and β is acute and wherein the angles α and β form first and second planes respectively which are orthogonal with respect to each other.

l	56. (Previously Presented) A method of making a magnetic layer and/or an
2	antiferromagnetic (AFM) layer for an electrical device comprising the steps of:
3	obliquely ion beam sputtering at least one material layer from a target onto a substrate to
1	form said magnetic layer and/or antiferromagnetic (AFM) layer;
5	the oblique ion beam sputtering being at angles α and β wherein each angle α and β is
5	acute and wherein the angles α and β form first and second planes respectively which are
7	orthogonal with respect to each other; and
3	the angle β being 10° to 30°.
l	57. (Previously Presented) A method of making a magnetic layer and/or an
2	antiferromagnetic (AFM) layer for an electrical device comprising the steps of:
3	obliquely ion beam sputtering at least one material layer from a target onto a substrate to
4	form said magnetic layer and/or antiferromagnetic (AFM) layer;
5	the oblique ion beam sputtering being at angles α and β wherein each angle α and β is
6	acute and wherein the angles α and β form first and second planes respectively which are
7	orthogonal with respect to each other; and
8 -	the angle β being 20° and the angle α being 40°.
1	58. (Previously Presented) A method of making a magnetic layer and/or an
2	antiferromagnetic (AFM) layer for an electrical device comprising the steps of:
3	obliquely ion beam sputtering at least one material layer from a target onto a substrate to
4	form said magnetic layer and/or antiferromagnetic (AFM) layer;
5	the oblique ion beam sputtering being at angles α and β wherein each angle α and β is
6	acute and wherein the angles α and β form first and second planes respectively which are
7	orthogonal with respect to each other, and
8	the angle β being 30° and the angle α being 40°.
1	59. (Previously Presented) A method as claimed in claim 55 wherein said at least
2	one material layer is a nickel iron film and first and second cobalt based films with the nickel iron
3	layer being located between the first and second cobalt based films for forming said magnetic
4	layer.
1	60. (Previously Presented) A method of making a magnetic layer and/or an
2	antiferromagnetic (AFM) layer for an electrical device comprising the steps of
3 .	obliquely ion beam sputtering at least one material layer from a target onto a substrate to

form said magnetic layer and/or antiferromagnetic (AFM) layer;

•			
5	the oblique ion beam sputtering being at angles α and β wherein each angle α and β is		
6	acute and wherein the angles α and β form first and second planes respectively which are		
7	orthogonal with respect to each other;		
8	said at least one material layer being a nickel iron film and first and second cobalt based		
9	films with the nickel iron layer being located between the first and second cobalt based films for		
10	forming said magnetic layer; and		
11	a second material layer comprising a nickel oxide film and an α phase iron oxide film that		
12	interface one another being obliquely ion beam sputtered at said angles α and β for forming said		
13	antiferromagnetic layer		
1	61. (Previously Presented) A method as claimed in claim 60 wherein for each		
2	of said magnetic and AFM layers the angle β is 10° to 30°.		
1 .	62. (Previously Presented) A method as claimed in claim 61 wherein for said		
2	magnetic layer the angle β is 20° and the angle α is 40°.		
1	63. (Currently Amended) A method as claimed in claim 55 wherein the electrical		
2	device is a magnetic head assembly and further comprises the steps of:		
3	said at least one material layer being a ferromagnetic free layer;		
4	a ferromagnetic pinned layer;		
5	a nonmagnetic spacer layer located between the free and pinned layers; and		
6	the pinned and spacer layers being ion beam sputtered at [[an]] only said angle α which		
7	is acute and at an angle β which is zero.		
1	64. (Previously Presented) A method of making a magnetic layer and/or an		
2	antiferromagnetic (AFM) layer for an electrical device comprising the steps of:		
3	obliquely ion beam sputtering at least one material layer from a target onto a substrate to		
4	form said magnetic layer and/or antiferromagnetic (AFM) layer;		
5	the oblique ion beam sputtering being at angles α and β wherein each angle α and β is		
6	acute and wherein the angles α and β form first and second planes respectively which are		
7	orthogonal with respect to each other;		
8	said at least one material layer being a ferromagnetic free layer;		
9	forming a ferromagnetic pinned layer;		
10	forming a nonmagnetic spacer layer between the free and pinned layers, and		
11	the pinned and spacer layers being ion beam sputtered at an angle α which is acute and at		

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an angle β which is 10° to 30°.

,	(5	(Drawin and Drawntad)	A method as claimed in claim 64 wherein the free
1	65.	(Previously Presented)	
2	layer has a magnetic moment with an easy axis and the oblique sputtering of the free layer is do in the presence of a magnetic field oriented parallel to said easy axis.		
3	in the present	ce of a magnetic field offented	paramer to said easy axis.
1 .	66.	(Previously Presented)	A method as claimed in claim 65 wherein after
2	oblique sputte	ering the free layer the free lay	ver is annealed at a temperature from 150°C to 270°C
3	in the present	ce of said field oriented parall	el to said easy axis.
1	67.	(Previously Presented)	A method as claimed in claim 66 wherein for the free
2	layer the ang	le β is 20° and the angle α is	40°.
1.	68.	(Previously Presented)	A method as claimed in claim 67 wherein for the
2	pinned and sp	pacer layers angle α is 40°.	
1	69.	(Previously Presented)	A method as claimed in claim 68 further including
2 .	the steps of:		
3	formi	ng said antiferromagnetic (AF)	M) layer interfacing the pinned layer wherein the AFM
4	layer include	es a nickel oxide film and an	a phase iron oxide film that interface one another, and
5	ion b	eam sputtering the nickel oxi	de film and the α phase iron oxide film at angles α and
6	β wherein e	ach angle α and β are acute	and wherein the angles α and β form first and second
7	planes respec	ctively which are orthogonal	with respect to one another.
1	70.	(Previously Presented)	A method as claimed in claim 69 wherein for the
2	AFM layer the	he angle α is 40° and angle β	is 10° - 30°.
1	71 .	(Previously Presented)	A method as claimed in claim 32 wherein the
2	forming of t	the spacer layer includes oblid	que ion beam sputtering copper at angles $\alpha = 40^{\circ}$ and
3	$\beta = 10^{\circ} - 30^{\circ}$	0° with angles α and β being 0	orthogonal .
1	72 .	(Previously Presented)	A method as claimed in claim 41 wherein the
2	forming of	the spacer layer includes obli	ique ion beam sputtering copper at angles $\alpha = 40^{\circ}$ and
3	$\beta = 10^{\circ} - 30^{\circ}$	0° with angles α and β being	orthogonal.
1	73 .	(Previously Presented)	A method as claimed in claim 48 wherein the
2	forming of	the spacer layer includes obl	ique ion beam sputtering copper at angles $\alpha = 40^{\circ}$ and
2	R - 10° 30	no with anales a and B being	orthogonal

I-	74. (Previously Presented) A method of ion beam sputtering at least one layer		
2	comprising the steps of:		
3.	providing a substrate with a first planar surface;		
4	providing at least one target with a second planar surface wherein the target is compose		
5	of a desired material for said layer;		
6	positioning the planar surfaces at angles α and β with respect to one another wherein angle		
7	α forms a first plane intersecting the first and second planar surfaces and angle β forms a second		
8	plane intersecting the first and second planar surfaces as well as the first plane with the		
9	intersection of the first and second planes being orthogonal with respect to each other, and		
10	ion beam sputtering the target so that said material is sputtered from the target onto said		
11	substrate to form said layer.		
1	75 (Davidson la Davidson la Da		
2	75. (Previously Presented) A method as claimed in claim 74 wherein a central		
2	ion beam lies within said first plane.		
1	76. (Previously Presented) A method of ion beam sputtering at least one layer		
2	comprising the steps of:		
3	providing a substrate with a first planar surface;		
4	providing at least one target with a second planar surface wherein the target is composed		
5	of a desired material for said layer,		
6	positioning the planar surfaces at angles α and β with respect to one another wherein angle		
7	α forms a first plane intersecting the first and second planar surfaces and angle β forms a second		
8	plane intersecting the first and second planar surfaces as well as the first plane with the		
9	intersection of the first and second planes being orthogonal with respect to each other; and		
10	ion beam sputtering the target so that said material is sputtered from the target onto said		
11	substrate to form said layer;		
12	a central ion beam lying within said first plane, and		
13	the angle β being 10° to 30°.		
1	77. (Previously Presented) A method of ion beam sputtering at least one layer.		
2	comprising the steps of:		
3 .	providing a substrate with a first planar surface,		
4	providing at least one target with a second planar surface wherein the target is composed		
5	of a desired material for said layer,		

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6	positioning the planar surface
7	α forms a first plane intersecting th
8	plane intersecting the first and s
9	intersection of the first and second
10	ion beam sputtering the tar
11	substrate to form said layer;
12	a central ion beam lying with
13	the angle β being 20° and t
•,	
. 1	78. (Previously Present
. 2	comprising the steps of:
3	providing a substrate with
4	providing at least one target
5	of a desired material for said layer,
6	positioning the planar surfac
7	α forms a first plane intersecting th
8	plane intersecting the first and
9	intersection of the first and second
10	ion beam sputtering the tar
11	substrate to form said layer,
12	a central ion beam lying wi
13	the angle β being 30° and t
1	79. (Previously Presente
2	one layer is a nickel iron film and
3	being located between the first and

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es at angles α and β with respect to one another wherein angle e first and second planar surfaces and angle β forms a second second planar surfaces as well as the first plane with the planes being orthogonal with respect to each other; and

get so that said material is sputtered from the target onto said

thin said first plane; and the angle α being 40°.

ed) A method of ion beam sputtering at least one layer

a first planar surface;

t with a second planar surface wherein the target is composed

es at angles α and β with respect to one another wherein angle ne first and second planar surfaces and angle β forms a second second planar surfaces as well as the first plane with the planes being orthogonal with respect to each other; and

get so that said material is sputtered from the target onto said

thin said first plane; and the angle α being 40°.

- ed) A method as claimed in claim 75 wherein said at least first and second cobalt based films with the nickel iron film d second cobalt based films for forming said layer.
- 80. (Previously Presented) A method of ion beam sputtering at least one layer comprising the steps of:

providing a substrate with a first planar surface;

providing at least one target with a second planar surface wherein the target is composed of a desired material for said layer;

positioning the planar surfaces at angles α and β with respect to one another wherein angle α forms a first plane intersecting the first and second planar surfaces and angle β forms a second plane intersecting the first and second planar surfaces as well as the first plane with the intersection of the first and second planes being orthogonal with respect to each other; and

10	ion beam sputtering the target so that said material is sputtered from the target onto said		
11	substrate to form said layer;		
12	a central ion beam lying within said first plane;		
13	said at least one layer being a nickel iron film and first and second cobalt based films with		
14	the nickel iron film being located between the first and second cobalt based films for forming said		
15	layer; and		
16	a second layer comprising a nickel oxide film and an α phase iron oxide film that interface		
17	one another being obliquely ion beam sputtered at said angles α and β for forming another layer		
1	81. (Previously Presented) A method as claimed in claim 80 wherein for each		
2	of said layer and said other layer the angle β is 10° to 30°.		
1	82. (Previously Presented) A method as claimed in claim 81 wherein for said		
2	layer the angle β is 20° and the angle α is 40°.		
1	83. (Currently Amended) A method as claimed in claim 75 wherein said method		
2	forms a magnetic head assembly further comprising		
3	said at least one layer being a ferromagnetic free layer;		
4	forming a ferromagnetic pinned layer,		
5	forming a nonmagnetic spacer layer between the free and pinned layers; and		
6	the pinned and spacer layers being ion beam sputtered at [[an]] only said angle α . which		
. 7	is acute and at an angle β which is zero.		
1	84. (Original) A method as claimed in claim 83 wherein for the free layer the angle		
2	β is 10° to 30°.		
1	85. (Original) A method as claimed in claim 84 wherein the free layer has a		
2	magnetic moment with an easy axis and the oblique sputtering of the free layer is done in the		
3	presence of a magnetic field oriented parallel to said easy axis.		
1	86. (Original) A method as claimed in claim 85 wherein after oblique sputtering		
2	the free layer the free layer is annealed at a temperature from 150°C to 270°C in the presence of		
3	said field oriented parallel to said easy axis.		

1	87.	(Original)	A method as claimed in claim 86 wherein for the free layer the angl
2	β is 20° and	the angle α is 4	40°.
1	88.	(Currently A	Amended) A method as claimed in claim 87 wherein for th
2	pinned and sp	pacer layers ang	igle α is 40° and angle β is 0°.
1	89.	(Original)	A method as claimed in claim 88 further comprising:
2	formi	ng an antiferro	omagnetic (AFM) layer interfacing the pinned layer wherein the AFM
3	layer include	es a nickel oxid	de film and an α phase iron oxide film that interface one another, an
4	ion be	eam sputtering	g the nickel oxide film and the α phase iron oxide film at angles α and
5	β wherein ea	ach angle α an	nd β are acute and wherein the angles α and β form first and secon
6	planes respec	ctively which as	are orthogonal with respect to one another.
1	90.	(Original)	A method as claimed in claim 89 wherein for the AFM layer th
2	angle α is 40	° and angle β i	is 10° - 30°.

91.- 93. Canceled